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The study of waves, instabilities, and turbulence using Thomson scattering in laser plasmas.

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Much basic work in plasma physics has been devoted to the study of wave properties in plasmas, of the nonlinear development of driven waves, and of the instabilities in which such waves may participate. The use of laser-plasma techniques has allowed us to extend such studies into new regimes. Such techniques and their results are the subject here.

Once one chooses a physical problem within this subject area, it is now possible to design a laser-plasma experiment that is optimized for the study of that problem. The plasma can be designed to have a variety of density and flow-velocity profiles, the damping of ion acoustic waves and of electron plasma waves can be independently controlled, and the waves can be driven weakly or strongly. By using Nd-glass lasers and their harmonics one can non-invasively drive and diagnose the waves, using separate laser beams to produce the plasma, drive the waves, and diagnose their properties.

I will use as examples some recent work with my collaborators, including the first experimental detection of ion plasma waves and the first direct observation of the plasma wave driven by the acoustic decay of laser light.

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